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Effects of the diversion of the Danube on two ruffe species in the Szigetköz area

by
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Abstract: After the diversion of the Danube, the resulting habitat loss and alteration negatively affected the condition of the surviving populations of two ruffe species. The oldest individuals appeared to be most sensitive to these changes. Because of these alterations, the future existence of *Gymnocephalus baloni* in the Szigetköz area seems doubtful.
Key words: habitat alteration, Gabcikovo Hydropower Dam, *Gymnocephalus cernuus*, *Gymnocephalus baloni*, condition, age structure.

Introduction

The diversion of the River Danube (on October 25, 1992 at Cunovo) resulted in the diminution of fish habitats in the Szigetköz area. The total water surface of the side branches shrunk to 30% of the original value, and the water level sank so strongly that considerable depth remained at very few sites only (e.g. in deep pools behind cross dams). As a consequence, the surviving fish population crammed together in these areas. The inundation that arrived in November 1992 filled up the branch system again, displacing the fish from their refugia, which, after the inundation had passed, were crammed together in the deeper parts again (also this time greatly reduced in numbers). During winter (1992/93), the population suffered again (specimens of both *Gymnocephalus cernuus* and *G. baloni* died in considerable numbers at this occasion). As a result of the inundation in July 1993, and the advancing artificial water recharge, the aquatic habitat expanded again (even though the original parameters [e.g. discharge] could not be restored).

Studies dealing with the expected ichthyofaunistic changes were conducted even in the earliest stages of the construction of the Gabcikovo-Nagymaros river barrage system (Holcik *et al.* 1981, Jancsó & Tóth 1987, Tóth 1983, Vida 1990a, b, 1993a). As the Gabcikovo hydropower dam came into force, the original fish fauna of the Szigetköz area suffered a considerable reduction, which is believed to intensify in the future (Guti 1993, Vida 1993b).

We investigated to what extent the surviving populations of two species of ruffe – *Gymnocephalus cernuus* (limnophilous) and *G. baloni* (rheophilous) – were affected by the above mentioned processes.

Material and method

Adult specimens collected by electrofishing, lift nets and angling device in the Ásvány branch system of the Szigetköz area (1823 to 1816 rkm) between 1989 and 1994 were used in the study (in total, 151 specimens of *G. baloni* and 157 specimens of *G. cernuus*). The sporadical data used for comparison

are based on studies conducted at the Háros section of the main channel of the Danube (1635 to 1634 rkm) in 1993 (50 specimens of *G. baloni* and 49 specimens of *G. cernuus*).

The changes observed in the populations of ruffes in the Szigetköz area were described by using Fulton's condition factor (Fulton 1911, cit. Ricker 1975): $CF=100\ W/l^3$ (where "w" stands for body mass in g, "l" for standard length in cm [resulting in CF±s, where "s" stands for standard deviation]), and by the age structure of the adult population (ageing as made on the basis of scale rings). To create comparable conditions, the samples used included spring, summer and winter collectings at the same rate. To have samples with similar length distribution the older specimens ($5^+ - 9^+$) were excluded from the condition analysis because of their uneven presence in the catches. (The average body lengths were 84.3±16.8 mm, 85.9±8.3 mm and 87.5±10.3 mm at *G. baloni*. The same were 87.6±11.5 mm, 91.5± 14.8 mm, 93.8±9.2 mm and 93.6±10.7 mm at *G. cernuus*). The sex ratios of the samples were also similar (statistically not differing from 1:1).

To demonstrate differences, t-test (condition) and chi-square- (χ^2-) tests (age distribution) were performed, and the significance levels (p) of these were given.

Results

In the year 1993, the age structure of the adult populations of both *G. cernuus* and *G. baloni* inhabiting the branch system in the Szigetköz area underwent a change. As of *G. cernuus*, individuals older than 4 years in 1992 constituted 28.6% of the adult population, whereas the same was only 10.8% ($p<0.05$) for 1993. A similar, but even more pronounced tendency could be observed in the case of *G. baloni*, in which the ratio of specimens older than 4 years fell from 25% experienced between 1989 and 1992 to 3.2% (p). The reason for this decline is probably the worse adaptability of adult individuals to habitat alterations.

After the diversion of the Danube, changes in the condition of the surviving populations were equally evident. For 1993 the condition of both ruffe species greatly impoverished (Fig. 1.). In *G. cernuus* this reduction was 17.1% ($CF_{1992}=2.45±0.31$, against $CF_{1993}=2.03±0.17$), whereas it was 8.6% ($CF_{1989\text{-}92}=2.78±0.28$, against $CF_{1993}=2.54±0.22$) in *G. baloni* ($p<0.001$ in both cases).

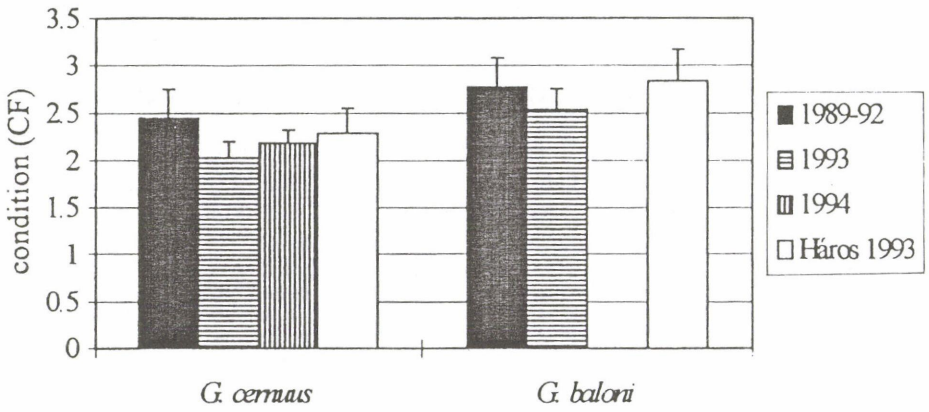

Fig. 1.: The conditions (Fulton's condition factor) of *Gymnocephalus baloni* and *G. cernuus* in the Szigetköz side branch system (1989-1994) and at the Háros section of the Danube (in 1993).

In the year 1994, some improvement in the condition of *G. cernuus* could be experienced (CF_{1994}=2.19±0.13, p 0.001), but this was still very much below the level of 1992. As revealed by our observations, similar tendencies could be experienced in the case of breams, but due to the lack of earlier data, no direct comparison could be made.

Additionally, *G. baloni* could be found only in limited numbers in 1993, and subsequently it could no longer be collected in 1994, even though it was abundant in the area until the end of 1992 (e.g. at the Gombócos, Halrekesztő and Árvai cross dams). The impoverishment of the condition of the ruffes can possibly be explained by the food scarcity that resulted from habitat diminution. In the case of *G. baloni*, another reason could be the reduction of the current velocity (parallel with the reduction of discharge) and the silting-up connected herewith. (Before the diversion, seasons of limited discharge occurred e.g. during winter, but these were soon to be followed by seasons of higher discharge, which thoroughly flushed the branches. In contrary, after diversion the water flow in most of the branches was reduced or became stagnant)

Conclusions

1. The diversion of the Danube most strongly affected the older specimens of the two ruffe species.
2. The condition of surviving ruffe populations strongly impoverished to 1993, which could be explained by the food scarcity occurring after the dwindling of habitats.
3. The impoverished condition of the populations and the absence of older individuals will on the long run negatively affect both ruffe species, as the above tendencies possibly influenced spawning in 1993 and 1994.
4. The regeneration of the *G. cernuus* population started already in 1994, and within a few years the population is expected to reach a state of balance on a possibly reduced level.
5. *G. baloni* could not be found in the Szigetköz in 1994 in spite of intensive searching, which, unfortunately, may indicate that this fish species (protected in Hungary since 1993) is in danger of becoming extinct in the area under concern.

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